Intraspecific leaf functional trait variation and foliar disease in agroecosystems

Abstract

Background/Question/Methods

Quantifying intraspecific functional trait variation of crops provides an understanding of how plants respond to environmental stimuli and in turn influence agroecosystem functioning. Recent research has advanced our understanding surrounding the soil and climatic drivers of intraspecific trait variation (ITV) in crops. However, little research to date has tracked how leaf ITV influences plant susceptibility to foliar disease. While many studies on foliar disease focus on the biochemical responses to pathogens, this study examines the interacting role of leaf ITV in foliar disease severity at a plant-scale. Using *Coffea arabica* as a model species, we quantified coffee leaf rust (CLR) severity – a fungal disease prominent in coffee systems – and measured key coffee leaf functional traits under contrasting but widespread management conditions in a biodiverse agroecosystem.

Results/Conclusions

Coffee leaf traits expressed significant ITV, with coefficients of variation ranging from 10.3-57.7% across 173 plants. Trait variability was most strongly linked with the canopy stratum in which leaves were positioned. Within the middle stratum, leaves had the highest CLR severity along with lower values of traits related to leaf structural investment (*e.g.* lower leaf mass area, lower leaf dry matter content, lower carbon to nitrogen ratio). These results represent among the first lines of evidence indicating that crop ITV plays a role in mediating disease severity in agroecosystems. In doing so our work advances not only our understanding of the ecology of a major crop pathogen, but also indicates that plant ITV plays a key role in governing plant-pathogen interactions in terrestrial ecosystems.

authors

- Stephanie Gagliardi
  - University of Toronto Scarborough
- Jacques Avelino
  - CATIE
  - Université de Montpellier
  - CIRAD
- Adam R. Martin
  - University of Toronto Scarborough
- Marney E. Isaac
  - University of Toronto Scarborough